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Chongyang Gao, Bin Zhan, Lianyi Chen, Xiaochun Li

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A micromechanical model of graphene-reinforced metal matrix nanocomposites with consideration of graphene orientations

Chongyang Gao [1, *], *Bin Zhan* [2], *Lianyi Chen* [3], *Xiaochun Li* [3]

[1] *The State Key Lab of Fluid Power and Mechatronic Systems, College of Mechanical Engineering, Zhejiang University, Hangzhou, 310027, China*

[2] *Key Laboratory of Advanced Manufacturing Technology of Zhejiang Province, College of Mechanical Engineering, Zhejiang University, Hangzhou , 310027, China*

[3] *Department of Mechanical and Aerospace Engineering, University of California at Los Angeles, Los Angeles, California 90095, USA.*

Abstract

In this paper, a new micromechanical model is developed for graphene-reinforced metal matrix nanocomposites (MMNCs) to effectively describe the mechanical properties of the new attractive engineering materials with high specific strength. The key influence of the misorientation of randomly-distributed graphene nanoplatelets (GNPs) is especially considered. The strain rate and temperature effects are also introduced through the dislocation-mechanics-based metal matrix model. Then the new model is applied to the nanocomposites of GNP/Al2024, GNP/Al and GNP/Cu, respectively. The comparison of model predictions and experimental data suggests that the model can represent the elastoplastic deformation behaviors of the graphene-reinforced MMNCs well. The strengthening effect by graphene in the nanocomposites is approximately linear to its volume fraction within a small range and also to the aspect ratio of graphene

* Corresponding author: Phone: + 86 571 87953929; Fax: + 86 571 87953929.

E-mail address: lxgao@zju.edu.cn